

LIBRARY
23 JUN 1945
U.S.A. 126.
R

Vol. XXI

April, 1945

No. 2

THE PAN-PACIFIC ENTOMOLOGIST

Published by the
Pacific Coast Entomological Society
in co-operation with
The California Academy of Sciences

CONTENTS

GOLDSCHMIDT, EVOLUTION OF MOUTH PARTS IN DIPTERA—A COUNTER CRITIQUE	41
HARE, FLYING STAGE OF THE DEER LOUSEFLY, LIPOPTENA DEPRESSA (SAY), IN CALIFORNIA.....	48
SAMPSON, FIVE NEW SPECIES OF ALEYRODIDAE FROM CALIFORNIA.....	58
SEEVERS, NEW GENERA AND SPECIES OF TRICHOPSENINAE FROM AMERICAN AND AUSTRALIAN TERMITE NESTS.....	63
FENDER, OREGON CHRYSOMELIDAE.....	72
JENSEN, NOTES ON THE SYNONYMY, NYMPHS AND DISTRIBUTION OF HETEROPSYLLA TEXANA CRAWFORD.....	74
FENDER, NOTES ON THE SPECIES OF PODABRUS OF OREGON AND WASHINGTON.....	77

San Francisco, California

1945

THE PAN-PACIFIC ENTOMOLOGIST

EDITORIAL BOARD

E. C. VAN DYKE
Associate Editor

R. L. USINGER*

E. G. LINSLEY
Editor

G. F. FERRIS

R. C. MILLER, *Treasurer*

R. W. L. POTTS
Assistant Editor

E. S. ROSS*

* *On military leave*

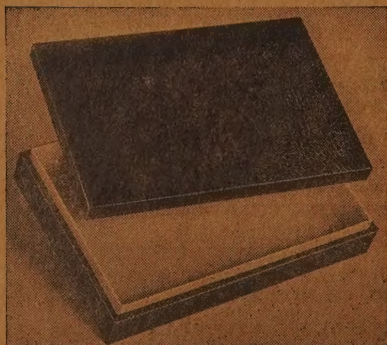
Published quarterly in January, April, July, and October with Society Proceedings appearing in the January number. Papers on the systematic and biological phases of entomology are favored, including articles up to ten printed pages on insect taxonomy, morphology, life history, and distribution.

Manuscripts for publication, proof, and all editorial matters should be addressed to the editor, E. G. Linsley, 112 Agriculture Hall, University of California, Berkeley, California. All communications regarding non-receipt of numbers, changes of address, requests for sample copies, and all financial communications should be addressed to the treasurer, R. C. Miller, at the California Academy of Sciences, San Francisco, California.

At least twenty-five "author's extras" will be supplied free of charge. Additional copies will be *reprinted* at cost of publication, if a request is received when proof is returned.

Domestic and foreign subscriptions \$2.50 per year in advance. Price for single copies 75 cents. Make checks payable to "Pan-Pacific Entomologist."

INSECT BOXES



Standard size black insect box with sides of box and cover made of $\frac{1}{4}$ " redwood. The top, bottom and shoulders are of heavy cardboard.

Inside dimensions:
 $12\frac{1}{4} \times 8\frac{1}{4} \times 2\frac{1}{8}$ inches.

Prices:

60 cents each.

Lots of one dozen, 50 cents each.

With Masonite bottom, 15 cents extra.

With glass top, 50 cents extra.

Prices for larger quantities on request.

Unit boxes also manufactured

Prices on application

RAISIN AND THIEBAUT BROS., LTD.

346 First Street, San Francisco, Calif.

Entered as second class matter, February 10, 1925, at the postoffice at San Francisco, California, under Act of August 24, 1912.

The Pan-Pacific Entomologist

Vol. XXI, No. 2

April, 1945

2

EVOLUTION OF MOUTH PARTS IN DIPTERA A COUNTER CRITIQUE

BY RICHARD B. GOLDSCHMIDT

University of California, Berkeley

In a recent review of that homoeotic mutants of *Drosophila* my former student, C. Villee, made some statements on homologies of Dipteran mouth parts (taken over from Bridges and Dobzhansky's paper on the *Drosophila* mutant *proboscidea*). Later he commented briefly, though rather dogmatically, on the evolutionary significance of those mutants, following the present author's viewpoints as developed in a recent book (1940). Villee's remarks on both these topics have been strongly criticised by the excellent entomologist, G. F. Ferris. As this criticism does not involve questions of entomological detail unknown to the outsider, but broad and general problems of evolution it ought to be considered carefully and discussed by non-entomologists.

Ferris' first, rather acid critique was directed against the geneticist's claim to have established some decisive arguments in controversial problems of homology. The organ under discussion is the oral lobe or labellum in the proboscis of Diptera. Old authors (Lowne) homologized it to the maxillae, but this had been given up long ago by dipterologists, some of whom considered the oral lobes as derived from the paraglossae while the more modern view derives them from the labial palpi. Villee, repeating remarks made by Bridges and Dobzhansky, pointed out that the mutant proboscipedia with antennae or tarsi instead of the oral lobes proves definitely that Lowne was wrong. He did not further discuss the development of the problem subsequent to Lowne's paper because part of the literature had been quoted by Bridges-Dobzhansky whom he followed in his discussion. Ferris rebuked rather strongly the geneticist who assumes the right to decide upon a problem of comparative morphology. He wrote: "So far, so good. This is merely a fact which is well enough known to any morphologist of the present day and the contribution of genetics is not necessary to confirm it." Further, after quoting Villee's remark that the mutant shows that the oral

lobes are homologous to labial palpi, he said: "Villee seems to have been unaware of any work that has been done in the morphology of insects since the date of Lowne (1890), for evidence has been presented on morphological grounds alone, by at least three authors, which demonstrates beyond any reasonable doubt that the 'oral lobes' of flies are in fact nothing more than the labial palpi. We should not object to such confirmation of our morphological ideas as we can gain from geneticists"

This discussion, I think, has a significance beyond the present bone of contention. The present writer, who had passed the incriminated sentences for publication though overlooking the lack of reference to the modern interpretation, cannot be accused of lack of understanding for the morphologist's point of view, having spent many years of his life in work on comparative morphology and having been guilty of many more or less good phylogenetic homologisations on the basis of such work. But, I think, everybody ought to realize that problems of homology can, in many cases, be settled only by experimental, embryological, or genetical work. By comparing many different types the morphologist comes to definite conclusions the correctness of which increases with the quantity of the material available. Sometimes there will be no reasonable doubt for a homologisation and the actual proof furnished by the experimental work might amount to carrying owls into Athens. To take an example: The homologisation of the halteres of flies with wings is beyond any reasonable doubt. Thus the fact that a haltere may be transformed into a wing (*Drosophila* mutant *tetraptera*) or a wing into a haltere (mutant *tetraltera*) is not needed to establish the homology. But there are many homologies for which the situation is different and different schools draw different conclusions. To take again an example: There has been much discussion and divergence of opinion regarding the homologies between female and male genital armature and ducts in Lepidoptera. Some points could be settled by the study of development, but other homologies could only be finally established (by Goldschmidt and Kosminsky) when the geneticist produced all grades of intersexes in which the transformation of one part into the other (or the impossibility of it) could be seen. The supreme criterion of homology is experimentally transforming one member into the other.

In spite of Ferris' claims to the contrary and the condescendence apparent in the above quotation, I hold that the situation is not much different in the material under discussion. Though, no doubt, the present trend among dipterologists is to assume that the labella are the homologues of labial palpi, it cannot be overlooked that very good entomologists have held (and might still hold) that the proper homologues are the paraglossae. In the most recent general presentation of the subject known to me, the Dipterologist Hendel writes (1936): "*A generally accepted homologisation does not yet exist.*"¹ According to Peterson submentum and mentum are united more or less closely with the membrane of the sixth head sternite. He calls the boatshaped chitinous plate located ventrally in the labial proboscis the theca; he homologises the labella with the paraglossae as do Newport and Gershfield. I follow in the homologisation of the labial parts those authors who interpret the just mentioned ventral chitin plate of the trunk as the mentum, and the labella as labial palpi (Burmeister, Becher, Hewitt, Frey)." Almost at the same time Snodgrass (1935) writes in his well-known text: "The labella . . . have been generally regarded as the paraglossae, apparent rudiments of the glossae being sometimes present between them; but Crampton . . . has given reasons for believing that the labellar lobes are the labial palpi. Palpi, however, are typically provided with antagonistic muscles. The lobes of the fly labrum have usually only one muscle inserted directly upon it." Thus the standard entomological text does hardly consider Crampton's (and others) homologisation established "beyond reasonable doubt" and actually is leaning toward the other side.

To these statements I may add that among the old and new authors who agree with Frey are Erickson (1840), Kraepelin (1880), Grünberg (1907), Crampton (1923-25), Jobling (1927). Among those who are opposed to the homology of the labella with labial palpi are Wesché (1904), McGillivray (1924), Otanes (1922). The detailed and animated polemic on the subject between Crampton and McGillivray proves sufficiently that a final decision satisfying everybody cannot be reached by morphological comparison alone. (Professor E. G. Linsley has kindly drawn my attention to Crampton's most recent paper,

¹ Translated from the German; italics mine.

1942, in which he summarizes the data in favor of his interpretation and gives clearer drawings of mouth parts of Mecoptera and Diptera than contained in former publications.)

Thus to me these statements and facts convey the idea that the problem is still controversial and not solved "beyond any reasonable doubt" by comparative morphology. The genetical facts reported above furnish a complete proof of the interpretation. The geneticists who claim this (following Bridges and Dobzhansky, the latter himself trained as an entomologist) do not want to parade any superiority but just make the proper use of a superior tool, which they happen to wield.

There is a second part to Ferris' criticism. Villee had stated, following certain of the present author's views (1940) that the homoetic mutants demonstrate that it is not necessary for example, to assume that the oral lobe has been developed from the biting parts of lower insects by accumulation of small steps. Rather a single mutation affecting early embryonic processes may have effected this in one step. He adds, somewhat overshooting his mark, that animals with intermediate mouth parts would not have been able to feed.² To this Ferris remarks: "All of which can but wring an agonized scream from the depths of a morphologist's soul. The writer of that statement, like most non-entomologists, seems to be quite unaware of the fact that there are thousands upon thousands of species of flies other than *Drosophila melanogaster* and that these flies present probably hundreds of those various 'intermediate types of mouth parts' condemned by him, with which they get along very nicely. These degrees of development range from the perfectly normal, although but two-segmented palpus in the closely related and possibly even antecedent order Mecoptera through various modifications up to the highly bulbous palpi of the most specialized flies . . ." This statement clearly characterises my viewpoint, as repeated by my student, as based upon ignorance. But it may be assumed that a former, though rather amateurish collector of insects, including Diptera and Mecoptera, is familiar with the existence of flies other than *Drosophila*. Recollecting the structure of the many mouth parts of Diptera which I had once dissected in entomological classwork, I was unable to remember having seen all these transitions. Therefore, I asked Ferris by letter to name a few of

² My own statement (1940) of which this is a paraphrase says that gradations between generalized and specialized types would have died of starvation.

the hundreds of transitional stages which he had in mind and to help me to collect information on them. As no answer was received, I took the trouble to search for these transitions, believing that there might be an alternative to ignorance so complete that it makes souls scream: namely a different evaluation of what might be considered a transitional stage.

Again I consulted first the most recent monograph on Diptera by Hendel and found the following statement: "The labella or labial palpi are separate externally in primitive forms, independent but connected basally by a hyaline middle part which may be swelled. This connection has become more close in the course of evolution, especially in the Calypttrata." This statement, in my opinion, covers the crux of the matter. In the papers of Peterson, Frey, Crampton and Jobling descriptions can be found of the mouth parts and their comparative interpretation and in some of them detailed, in others only semi-diagrammatic figures. The interest centers upon the forms which are considered primitive by dipterologists. Crampton studied what he calls the most primitive living representative of the order Diptera, *Tanyderus*. Frey (1913) analysed a series of primitive types as *Bolitophila*, *Gnoriste*, *Sciara*, etc. Jobling (1927) discussed *Culicoides*. In all these cases we have the typical elongated labium whatever the homologisations of the parts with the mentum, submentum and palpiger of lower forms may be, much of which is controversial. The labella may still show traces of two segments, but they are bulbous, connected by a hyaline membranous middle part which can be swelled by blood pressure. The outer part is better chitinized and supported by chitinous arcs. Altogether the labella and their supports are incorporated into the functions of the proboscis into which the mouth parts combine. There are certainly many variations in detail but as a whole the principle of a dipteran labium is present from the beginning as far as I am able to find out. The dipterologists agree that these mouth parts are derived from those of the Mecoptera. But the only condition of transition which I can find in Diptera is the rudimentary segmentation of the primitive labellum. Thus it looks to me as if the decisive step to "dipterisation" was a single one, whether derived from a Mecopteran type, or if this is a blind side alley, from a more primitive one. It is possible that Ferris laid less stress upon the first establishment of the Dipteran type in his

"hundreds of transitional stages," though he starts his series with the Mecoptera as first transitional types. Villee had only spoken of the change of the primitive biting mouth parts (esp. labrum) into the Dipteran type. Probably Ferris alluded to the development of the specialized types, e.g., in *Drosophila*, from the primitive dipteran type. If one arranges the labella of many types of flies according to e.g., the number of pseudotracheae or the sense organs or the shape, one can certainly put them into a series, though not one of hundreds of steps, and certainly not a phylogenetic one. It has frequently been pointed out in evolutionary discussions that variable objects may be arranged in a series whenever quantitative variants are involved, but without any meaning in regard to the derivation of one from the other. If we take a crude example; we might arrange all brass instruments into an evolutionary series according to the number of valves or the bending of the tube or the size or all of them together. Is this an evolutionary series? There is certainly no transition between a tuba and a valve instrument. The last phylogenetic step, the saxophone, has probably not been derived from a horn or cornet, but from the constructive principles of some wood wind without any transitions. In the same way the existence of a labellum with one, two, four, many pseudotracheae in different Diptera, specialized for different ways of feeding does not imply that this represents an evolutionary series. Just as some mutation must have once produced the primitive two pseudotracheae from a form without them, also four of them may have originated at once by a different mutation. The same argument applies to all other specializations. Genetics has taught us that in series of multiple alleles of one character showing all transitions, e.g., from large wings to absence of wings, one mutational step may produce the extreme as well as any intermediate. In the case under discussion it has been shown that one mutational step transforms a highly specialized labellum into a segmented appendage. This makes us suspicious of graded series of evolution assembled from numerous variants going in all directions. But these are details. The decisive point is the first step from a biting labium to a sucking one, from a palpus to a labellum. For this I have, thus far, failed to find the numerous transitional steps, though one might say, comparing as types, *Periplaneta*, *Panorpa* and primitive fly, that the Mecoptera have gone in the direction

of Diptera in some respects but failed to take the decisive step which I can consider only as a single one. But even if the Mecoptera were the actual ancestors of the Diptera and the two-jointed palpus and rudimentation of glossae and paraglossae and the occasional presence of pseudotracheae (if true) were one of the proofs of this, the flat, biting type of mouth parts, though soft and reduced, is not yet a beginning of a dipteran type which involves the tubular, connected, swellable organ into which mentum, submentum, as well as the palpi enter by a proper transformation (which includes also muscles, sense organs, etc.) which it is not easy to imagine as having occurred in small steps.

LITERATURE

All papers mentioned in the text but not here cited, are quoted in one of the following papers; the most complete list is found in Crampton (1942).

BRIDGES, C. B. and TH. DOBZHANSKY

1932. Arch. f. Entwckl. Mech. der Organ. 127:575-590.

CRAMPTON, G. C.

1923. Proc. Ent. Soc. Wash. 25:171-180.

1925. Ibid. 27:68-90.

1942. Guide to the Insects of Connecticut, State Geol. Nat. Hist. Surv. Bull. 64(6):10-131.

FERRIS, G. F.

1943. Microentomology. 8(1):2-7.

FREY, R.

1913. Acta Soc. pro Fauna et Flora Fenn. 37:1-50.

1921. Ibid. 48:1-247.

GOLDSCHMIDT, R.

1934. Lymantria. Bibl. Gen. 11:1-180.

1940. The material basis of evolution. Yale Press, New Haven.

HENDEL, F.

1936-37. Diptera, in Handbuch d. Zool. 42:1729-1998.

JOBLING, B.

1927-28. Bull. Ent. Res. 18:211-236.

PETERSON, A.

1916. Illinois Biol. Monogr. 3:1-61.

SNODGRASS, R. C.

1935. Principles of insect morphology. New York.

VILLEE, C.

1942. Amer. Nat. 76:494-506.

2 FLYING STAGE OF THE DEER LOUSEFLY, LIPOPTENA
DEPRESSA (SAY), IN CALIFORNIA End
(Diptera, Hippoboscidae) S.B.

BY JOHN EDWARD HARE
University of California, Berkeley

Lipoptena depressa (Say) is a common bloodsucking ectoparasite of deer (genus *Odocoileus*) in western North America. As in other Hippoboscidae the females are larviparous, depositing at short intervals single full-grown larvae which immediately pupate.¹ The pupating larvae are smooth and clean, dropping from among the host hairs to the ground where the entire pupal period is passed. At emergence the imago possesses fully developed though fragile wings and flies among the trees in the woodland haunts of the host. This stage of the parasite, here called the *volant*, survives but a few days in the absence of the normal host. Upon reaching a deer, the volants immediately crawl between the hairs and begin to suck blood. Here they remain as permanent parasites for the rest of their lives, soon losing the wings by a simple process of wear.

In the course of a detailed study of the complete life history of this species over a period of six years, numerous observations have been made of the occurrence and behavior of the volants in California. The present paper is concerned only with the volant phase, i.e., that portion of the life cycle beginning at emergence from the puparium, and the subsequent events which lead to the finding of a host.

Little published information exists on the biology of *L. depressa*, and this almost exclusively concerns the parasitic stage on the deer. Spencer (1939) believed that young flies probably emerge at intervals throughout the spring in British Columbia, basing his conclusions on a study of mature parasites taken from deer carcasses in November. Bequaert (1942) mentions that flights of many winged, newly emerged individuals of both sexes are often observed in the fall, when they frequently alight on people and are said to bite readily. Cowan (1943) states that

¹ The gestation period of *L. depressa* is three to four days as found by experiments with captive deer, soon to be reported. Cowan (1943) estimated a two months period; Herman (Calif. Fish & Game, 31 (1), 1945) has repeated this figure.

volants often alighted on his clothing, and from rearing experiments on puparia deposited by females removed from dead deer, he concluded that emergence in the wild occurs from June to November in British Columbia. Herman (1945) includes photographs of the volant, puparium and parasitic female of *L. depressa*, as *Neolipoptena ferrisi* (Beq.)

I have observed and collected free flying volants in California at the following localities: Binkley Ranch, near Kelseyville, Lake County; 17-mile Drive, Carmel, Monterey County; Sespe Gorge, near Ojai, Ventura County; Mt. Diablo, Contra Costa County; Redwood Canyon and Strawberry Canyon, Alameda County. No attempt was made to survey the entire state to establish the geographic limits of distribution, but in general it may be said to coexist with that of the deer hosts.

Volants of *Neolipoptena ferrisi* (Bequaert) (*Lipoptena subulata* Ferris and Cole) have been collected along with *L. depressa* on only two occasions (Lake County, Ventura County) and then in very small numbers. *N. ferrisi*, although it accompanies *L. depressa* infestations on deer in many parts of California, appears to be more limited in distribution, at least with respect to coastal California.

Bequaert (1937, 1942) lists specimens of *L. depressa* from 29 of the 58 counties of California, from Humboldt, Trinity and Lassen in the north, to Orange, Riverside and San Diego in the south, and from the Pacific Coast to the Sierra Nevada Mountains. The races of *Odocoileus hemionus* (Mule and Blacktail deer) are widely distributed in California, according to Dixon (1934) and Cowan (1936), and are absent only from the hot interior valleys and from the Great Basin Desert region of southeastern California. The presence of infested deer in a given area, as determined by examination of carcasses during the hunting season, would indicate the occurrence of the volant stage in the same general area. Wherever intensive search was made in localities known to be frequented by deer, volants have sooner or later been found. In certain cases, notably Carmel, Mt. Diablo and Strawberry Canyon (Berkeley), many hundreds of volants have been observed and collected at frequent intervals during the warmer months of the year.

The conclusions here presented are based on a total of over 70 daily field trips, of which approximately 50 refer to the

Strawberry Canyon, Alameda County, locality, which served as the primary field station for the observation of wild volants.

SEASONAL OCCURRENCE

My earliest records for the year for the appearance of *L. depressa* volants are: March 26, 1941, 35 flies, Mt. Diablo; March 28, 1942, 24 flies, Mt. Diablo; March 18, 1944, 3 flies, Berkeley hills. Trips made to these localities during January and February of several years were negative. From March onward the volants appear in ever-increasing numbers as the weather grows warmer, until a peak is reached in the latter part of July, at which time as many as 200 flies have been caught in one hour, in an area of one acre. In the Berkeley station, for which I have the most complete records, the volant population appears to diminish during the months of August and September. Volants continue to occur in fairly good numbers on warm days in October and November, and four flies were caught flying as late as December 8, 1943. Volants have also been collected in August in Ventura County, September in Lake County, and October in Monterey County. On October 5, 1938, the flies were exceedingly numerous along 17-Mile Drive, Monterey County, and over 500 specimens were collected by three collectors in less than two hours. This indicates that the seasonal peak may extend into late fall in some localities.

VOLANT AND HOST ECOLOGY

It is to be expected that the ecological niche of the volant stage of *L. depressa* integrates with that of the host, since this stage of the cycle is devoted entirely to bringing it, fresh from emergence from the puparium in the forest floor, into contact with its host.

Bequaert (1942) gives the following as the normal, breeding hosts of *Lipoptena depressa*: *Odocoileus hemionus hemionus* (Rafinesque)—Rocky Mountain Mule Deer; *O. h. columbianus* (Richardson)—Columbian Blacktail Deer; *Odocoileus virginianus leucurus* (Douglas)—Western White-tailed Deer; *Cervus canadensis* (Erxleben)—the Wapiti or American Elk. The normal ecological pattern in California concerns races of *Odocoileus hemionus* only. Bequaert's list of specimens examined includes a record from *Odocoileus hemionus californicus* (Caton), and

in the absence of host identification of many other series of specimens, the localities given would indicate that *O. h. inyoensis* Cowan and *O. h. fuliginatus* Cowan may also be normal hosts of *L. depressa* (based on Cowan's study of the distribution of Pacific Coast Deer, 1936). The only California race of *Odocoileus hemionus* for which there seems to be no evidence, direct or indirect, of infestation by *L. depressa*, is *O. h. eremicus* (Mearns), the Burro Deer. According to Cowan, this race is found in California only in the extreme southeastern corner of the state, in the Lower Sonoran life-zone, chiefly below 1500 feet. This race of deer is isolated from the coastal races by the Colorado Desert, and has habits which are different from the *hemionus* Rassenkreis as a whole. Blacktail deer in California inhabit mainly the Transition and Boreal zones, but are also abundant in the Upper Sonoran chaparral belt of the coastal region, from Mendocino County southward. Cowan states that in the coastal regions the habitats favored are Redwood, Scrub Oak, and chaparral, while in the Sierran region the foothill chaparral belt and the Yellow Pine-chaparral association support the bulk of the population. Dixon (1934) considers California Mule Deer to be characteristic inhabitants of the Yellow Pine and White Fir forests in the central Sierran region, and has observed herds at elevations up to 11,000 feet.

From the above account it may be concluded that deer are to be found under a wide variety of floristic conditions, at all elevations up to at least 10,000 feet, and absent only from the most arid portions of the Lower Sonoran zone (cf. Grinnell, 1939).

At the collecting localities mentioned above, volants of *L. depressa* were collected in a number of different plant associations: Digger Pine, *Pinus sabiniana*. Lake County: Monterey Pine, *Pinus radiata*, mature growth—Monterey County, young growth—Alameda and Contra Costa counties; Cedar, *Chamaecyparis thyoides*, young plantings, Strawberry Canyon, Alameda County; Redwood, *Sequoia sempervirens*, Redwood Canyon, Alameda County; Pine-Oak-Juniper association (*Pinus sabiniana-Quercus douglasii-Juniperus californica*) Mt. Diablo, Juniper Camp, Contra Costa County; Laurel-Oak association (*Umbellularia californica-Quercus agrifolia*) Redwood Canyon; Willow-wild rose thicket (Riparian mountain meadow) Ventura County.

The volant habitats are all mesophytic in nature, when con-

trasted with the adjoining grassland and chaparral formations usually present at the same localities, but which are almost universally negative with respect to volants. Among the factors which appear to be important are, 1) moderate to dense shade (which directly modifies the temperature relations and the evaporation rate) and 2) shelter from wind. The shade factor is also involved in the production of a light-shade edge pattern which is commonly present in the volant habitats. The ecological relations of the light-shade edge will be discussed later.

Deer beds and other fresh sign were commonly present in the same vicinities as the highest volant densities. The highly localized occurrence of volants in these areas suggests that the flight range is quite limited.

In localities where the volants are habitually present, and during the warmer hours of the day, considerably more flies can be caught on the body of the collector than in a net. It is more accurate to say that the flies seek out the collector than the reverse. The volants have the habit of alighting suddenly on almost any part of the body, clothed or exposed. Here they pause for a fraction to several seconds, and then just as suddenly fly off again. By acting quickly, it is possible to capture the flies while they remain on the skin or clothing, by grasping them lightly between the fingers, or by inverting a collecting tube over them. The volants are small (3 mm.) flat, brown flies, with tough leathery bodies which can withstand considerable pressure and handling without injury, other than occasional tearing of the delicate wings.

Localities were surveyed simply by traversing, meanwhile being on the alert for any volants which might alight on the body. Specimens were obtained in this way even when the population density was so low that continuous beating for long periods did not yield a single fly by the conventional method. Sweeping and beating were useful during cold or wet weather or in the very early morning hours, when inactive or sluggish volants could be swept from edge foliage of trees, shrubs or grass in the same localities.

Of a total of over 600 individually recorded observations on volant behavior, approximately 17 per cent alighted on my body while I stood or moved in direct sunlight, another 17 per cent while in deep shade, and the balance, 66 per cent, occurred in or

close to the interzone produced at the edge of the distinct shadow cast by the trees which border the woodland formations. The occurrence of volants at this light-shade edge was very characteristic, and the highest frequencies of landings always took place here. Landings were most numerous when moving from shadows outward to bright sunlight, less when moving along the shadow edge, and least when moving from sunlight into shadow at right angles to shadow edge.

A similar behavior has been reported for the volants of *Lipoptena cervi* in Germany, by Schroeder (1911) who describes how over 100 specimens were caught as they alighted on several people crossing a clearing in a forest in Pomerania, in October. No details were given by Schroeder, but to collect that number of volants by hand requires time and care, and one may assume that the members of his party moved about the clearing while awaiting the flies.

The behavior of *L. depressa* volants may be attributed to the interaction of a number of responses, which probably include a phototaxis, form vision and light adaptation, and perhaps also detection of moving objects. Experiments have been conducted on the photic responses and other orientations of the volants, as well as on newly established and old feeding flies, and these will be reported in a later paper.

It is interesting to note that the behavior of tsetse flies, which in many ways are ecologically equivalent to the volant *L. depressa*, resembles closely that described above. Schwetz (1919) states that *Glossina fusca* Walker occurred almost exclusively along paths and roads bordering forests. *G. palpalis* R.-D. according to Fiske (1920), when in search of a host, follows game trails, lake shores and stream banks, and in general follows the line between shadow and sunlight, being averse to penetrating shadow where light is not evident beyond, and vice versa.

Swynnerton (1936) describes the "vegetational concurrence" required by *G. morsitans* Westw. for example, which requires both a savannah of sufficient shade value, and open glades in which to hunt prey. The feeding grounds are on sections of paths or glades and passes between thickets. Jackson speaks of the same species (1941) living in restricted "ambits", congregating along the "contact line of woodland and swamp, often in a special interzone including trees not found in either of the other types".

He states that the interzone provides good visibility and attractive conditions for the hosts, while the shadier woodland offers breeding and resting haunts.

The habits of the hosts of *L. depressa*, so far as they are known, fit into the volant pattern very well. Dixon (1934) states that mule deer in California spend the middle of the day bedded down in cool secluded nooks, such as groves of pines provide. Other bedding places are wild plum thickets, rocky ridges and hemlock thickets. To reach these spots, the deer must travel from the early morning feeding grounds in meadows and chaparral-covered hillsides, traversing patches of woodlands and the forest edges on the way. Here the volants have adequate opportunity to alight on the slowly moving or even momentarily stationary deer still browsing as they go. The bedding-down places are usually close to the forest edge, as the wary animals prefer a spot with an unobstructed view on one or two sides. In late fall and winter sunny nooks are sought for sun baths (Dixon, 1934, p. 35). As the shadows shift, the deer change their position, and move to other sun-bathed spots. This is precisely where volants habitually occur. The responses to temperature are also conducive to the rendezvous. Volants tend to retire into the deeper shadows on the warmest summer days, but on cool spring and fall days, the flies congregate in the warm sunny glades bounded by dense shadows. I have found by personal experience with captive blacktail deer that these animals are extremely light-shy on hot summer days, and seek the cool shadows whenever permitted. The reverse is true in cool weather.

DIURNAL CYCLE

During the night and in the first hours after dawn, volants may be recovered from foliage in the same localities where flights are made during the day. Crawling activity evidently begins as soon as light is present, when the temperature permits sluggish movement. Sluggish volants, their bodies wet with dew, have been observed dropping from branches of trees overhead as early as 5 A.M., just before dawn, on a cool foggy morning (13° C.). Volants kept at 10° C. overnight, move the legs and attempt to crawl almost immediately when brought into light.

Flights have been observed as early as 6:30 A.M. (still air temperature in this particular case was 18.0° C.) when the sun

was one hour above the horizon. The volants are also active on days with low fog, temperature permitting. The coolest conditions under which volants were seen flying, were recorded on December 1, 1943. From 1:20 P.M. to 2:30 P.M. the shade air temperature was 12.7–13.0° C. while the sunny air temperature was 18.5–23.0° C. Six volants were caught alighting on my body during this time. On another occasion, flight was slow and clumsy at 14–17° C., on a day with a low fog, which excluded the possibility of a warming effect by direct sunlight. The flies were seen to vibrate their wings several times before taking off in flight. This does not happen on warmer days, and suggests that under the cooler conditions, it is necessary for the volants to raise the internal temperature for proper function of the flight muscles, as pointed out by Wigglesworth (1939, p. 90) for other insects.

Optimum range of temperature for flight under field conditions appears to be 18–24° C. When the shade air temperature exceeds 25° C. the number of flies appearing at the forest edge decreases, as compared with average numbers caught on cooler days. The few flies present tend to remain in the deep shade, where they continue flying and resting activities. A similar type of reaction has been described for *Glossina morsitans* by Jack and Williams (1937) who found that as the temperature rises above 32° C. the response to light changes from photopositive to photonegative. They also showed that lowering the humidity lowers the threshold for this change in photic response.

Volants continue to make short flights throughout the day, frequently alighting on trunks and branches of trees, foliage and grass, where they rest briefly, and fly off again. One receives the impression of almost constant activity on the part of the flies. This restless behavior continues when the volants are put into dry collecting vials, where rapid crawling and flying still occur. Only with the coming of darkness and a drop in temperature does volant activity cease. Those flies surviving a longer period of starvation remain inactive on vegetation for the night and resume the search for a host the following day.

Cowan (1943) kept seven newly emerged volants of *L. depressa* over damp sand at room temperature. The maximum period of survival was 72 hours, average 57 hours. I have conducted

numerous survival experiments with reared as well as wild volants, and a brief summary of results will be given.

Volants of *L. depressa* lived from one to eight days after emergence from the puparium. The maximum survival was obtained with a group of reared flies emerging from normal puparia collected from captive deer. A total of twenty emergents were kept in small (20x6 mm.) vials plugged with cotton, in normal laboratory daylight, at room temperature and humidity: 50 per cent mortality at 4½ days, maximum survival, 1 fly 8 days. Wild caught volants, kept at 84 per cent relative humidity and 22.0–22.8° C. lived up to 3½ days, 50 per cent mortality at 1½ days, when kept under daylight conditions; when kept in dark cabinet, other conditions same, wild volants lived up to 6 days, 50 per cent mortality at 3¼ days. At 98 per cent R. H. and 16–19° C. wild volants lived up to 6 days, 50 per cent mortality at 4 days, when kept in dark cabinet. Lowering the humidity increases the mortality rate and shortens the maximum survival time. At room temperature and humidity, 75 per cent of wild volants kept in large glass jars die the first day. Factors which decrease the activities of the flies, hence the energy expended, tend to increase the maximum survival time and to lower the mortality rate. Such factors include: limiting the space for walking and flying, cutting down or excluding light, and lowering the temperature. A similar relationship was found for *Pseudolychnia canariensis* (Macq.) [*P. maura* (Bigot)] by Prouty and Coatney (1934), where longevity without food was 77–109 hours in direct proportion to the energy used up in activity.

Under natural conditions, the volant *L. depressa* may be expected to live and remain active for one to four days. Rearing experiments with captive deer indicate that 50 per cent of those volants still fairly active 4 days after emergence, can successfully establish on the host. One-day-old flies are 75 per cent successful.

LITERATURE CITED

BEQUAERT, J.

1937. Notes on Hippoboscidae. 5. The American species of *Lipoptena*. Bull. Brooklyn Ent. Soc. 32:91–101.
1942. A Monograph of the Melophaginae or Kedflies of sheep, goats, deer and antelopes. Ent. Amer. 22:1–220.

COWAN, I. MCT.

1936. Distribution and Variation in Deer (*Odocoileus*) of the Pacific Coastal Region of North America. Calif. Fish and Game, 22:155-246.

1943. Notes on the Life History and Morphology of *Cephenomyia jellisoni* Townsend and *Lipoptena depressa* Say. Canad. Journ. Res. 21:171-187.

DIXON, J. S.

1934. A study of the life history and food habits of Mule Deer in California. Calif. Fish and Game, 20:181-282, 315-354.

FISKE, W. F.

1920. Investigations into the Bionomics of *Glossina palpalis*. Bull. Ent. Res. 10:347-463.

GRINNELL, J.

1935. A revised life-zone map of California. Univ. Calif. Publ. Zool. 40:327-330.

JACK, R. W. and W. L. WILLIAMS

1937. The effect of temperature on the reaction of *Glossina morsitans* Westw. to light. Bull. Ent. Res. 28:499-503.

JACKSON, C. H. N.

1941. Economy of a tsetse fly (*G. morsitans*) population. Bull. Ent. Res. 32:53-55.

KINGHORN, A.

1911. Report on Human Trypanosomiasis in Ashanti (ms.). Bull. Sleeping Sickness Bur. 3:133. *quoted in* Newstead, 1924.

NEWSTEAD, R., A. EVANS and W. H. POTTS

1924. Guide to the study of Tsetse flies. Memoir (N.S.) no. 1, Liverpool School of Tropical Medicine, 332 pp.

PROUTY, M. J. and G. R. COATNEY

1934. Further studies on the biology of *Pseudolynchia maura* (Bigot). Parasitology, 26:249-258.

SCHROEDER, G.

1911. Beiträge zur Dipteren-Fauna Pommerns. Stett. Ent. Ztg., 72:367.

SCHWETZ, J.

1918. A comparative study of the habits of *Glossina brevipalpis* Newstead, *G. fusca* Westw., and *G. pallidipes* Austen, in the Belgian Congo. Ann. Trop. Med. Paras. 11:365-398.

SPENCER, G. J.

1939. Ectoparasites of Deer in British Columbia. Proc. Ent. Soc. Brit. Columbia. 35:15-19.

SWYNNERTON, C. F. M.

1936. The Tsetse Flies of East Africa. Trans. Roy. Ent. Soc. London, 84:1-579.

WIGGLESWORTH, V. B.

1939. Principles of Insect Physiology. E. P. Dutton and Co., New York.

FIVE NEW SPECIES OF ALEYRODIDAE FROM
CALIFORNIA
(Homoptera)

BY W. W. SAMPSON
University of California, Berkeley

Among the Aleyrodidae collected by the writer in California are five species whose characters do not resemble those of other described forms. These apparently new species are described herein. Holotypes and certain paratypes will be deposited in the California Academy of Sciences.

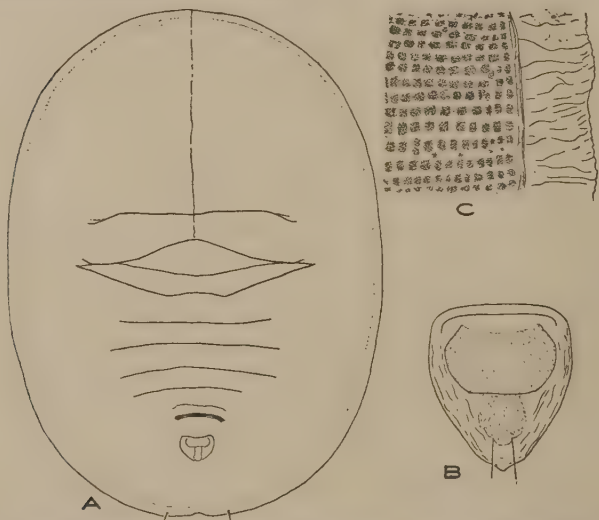


Fig. 1. *Aleyrodes osmaroniae* Sampson. A, pupal case. B, vasi-form orifice. C, margin of case.

Genus ALEYRODES Latreille, 1810

Aleyrodes osmaroniae Sampson, new species
(Fig. 1)

Pupal case. Size 1.28 mm. long by 0.97 mm. wide; shape broadly elliptical; margin slightly irregular, chitinized for a width of 0.35 mm.; behind the chitinized margin there occurs for some distance groups of dotted areas; vasi-form orifice subcordate and striated, the posterior margin pointed, operculum roundly trape-

zoidal, setose, lingular three-quarters the length of orifice, the two setae projecting beyond the margin of the orifice; caudal margin of body slightly indented and bearing two setae.

Color of case bright lemon yellow; without wax secretion.

Adults. Not known.

Collected by the writer from *Osmaronia cerasiformia* in Strawberry Creek Canyon, on the Campus of the University of California, BERKELEY, CALIFORNIA, June 14, 1941, along with *A. spiraeoides* (Q.) from the underside of the leaf.

This species differs essentially from *Aleyrodes spiraeoides* (Quaintance) by having the chitinized margin.

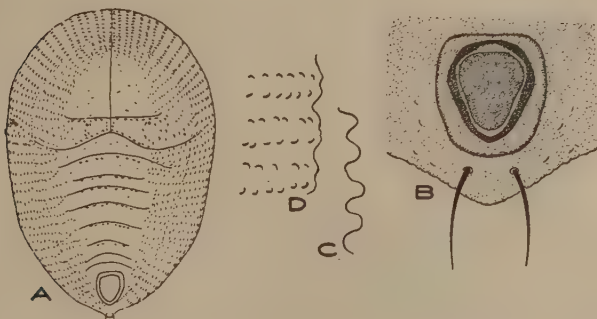


Fig. 2. *Tetrallicia ceanothi* Sampson. A, pupal case. B, vasi-form orifice. C, margin of case. D, apparent margin of case.

Genus TETRALICIA Harrison, 1917

Tetrallicia ceanothi Sampson, new species

(Fig. 2)

Pupal case. Size 0.623 mm. long by 0.540 mm. wide; shape broadly ovate, narrowing posteriorly; margin toothed, eight teeth in 0.0783 mm. wax tubes well developed; deflexed portion of case about one-fourth the width of case, 0.0703 mm. wide; apparent margin bears bidentate projections, which are the two rows of imbrications running over the edge to the deflexed portion; there are about 88 of these double rows of imbrications, which extend from the edges of the faintly indicated body segments to the margin; a few single imbrications are scattered over the dorsum; thoracic transverse slit not reaching apparent edge of body; vasi-form orifice subcordate, set in a roundly rectangular, chitinized area; operculum subcordate, nearly filling orifices; lingula hidden;

posterior prolongation slightly developed, bearing two long setae.

Case black, resting on a small amorphous mass of wax.

Adults. Not known.

Collected by Nathan Stahler and Thomas Kelly from *Ceanothus cuniatus* near BISHOP, CALIFORNIA, March 29, 1940.

This species is related to *Tetralicia nigrans* (Bemis), but differs essentially from it by having the wide chitinized area around the vasiform orifice and by having imbrications on the dorsum.

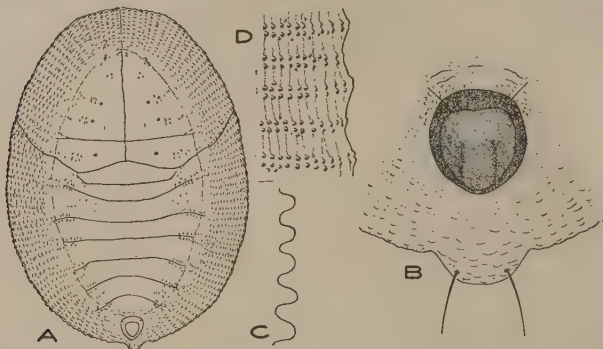


Fig. 3. *Tetralicia sierrae* Sampson. A, pupal case. B, vasiform orifice. C, margin of case. D, apparent margin of case.

Tetralicia sierrae Sampson, new species

(Fig. 3)

Pupal case. Size 0.820 mm. long by 0.450 mm. wide; shape elliptical; margin toothed, four teeth in 0.117 mm.; deflexed portion of case about one-third the width of case, 0.0783 mm. wide; apparent margin bearing bidentate projections with a smaller one in between each, the projections being the appearance of double rows of granules on the edge of the deflexed portion; the granules are lacking in the medium line of the dorsum; thoracic transverse slit reaching edge of apparent margin; vasiform orifice cordate, raised, slightly longer than wide; operculum cordate, filling orifice; lingula hidden; posterior prolongation well developed, bearing two long setae.

Case black, with a thin fringe of wax.

Adults. Not known.

Collected by the writer from an undetermined, low spreading shrub at TRUCKEE, CALIFORNIA, June 25, 1940.

This species is related to *T. ceanothi*, but differs essentially from it by having the case granulate and by not having the wide chitinized area around the vasiform orifice.

Genus *TRIALEURODES* Cockerell, 1902*Trialeurodes californiensis* Sampson, new species

(Fig. 4)

Pupal case. Size 1.07 mm. long by 0.74 mm. wide; shape broadly elliptical; margin entire, slightly irregular, with a few faint folds behind it; a single row of long pointed papillae lie behind the margin, nine in 0.16 mm.; behind the papillae are one or two rows of tiny clear pores, some of which are doubled, the same type of pores occur along each side of the abdominal ridge, one to each segment, and another row further out, as well as a few on the

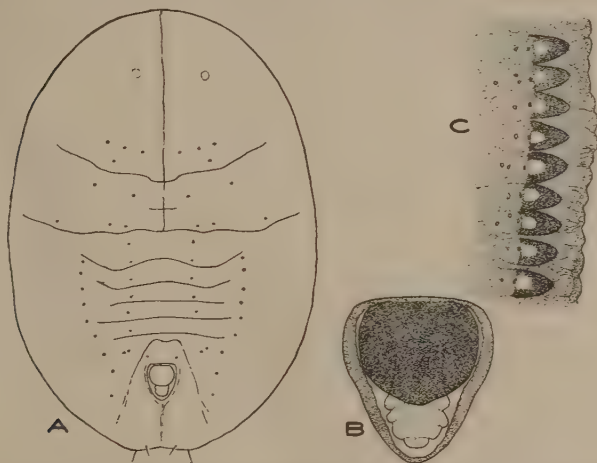


Fig. 4. *Trialeurodes californiensis* Sampson. A, pupal case. B, vasiform orifice. C, margin of case.

thorax; vasiform orifice subcordate; operculum rounded, filling about half of the orifice; lingula trilobed on each side, without setae nearly reaching to posterior margin of orifice; caudal furrow indicated; two pairs of hairs are located on the posterior margin.

Case black, with a fringe of wax up to one-half the width of case, dorsum without wax; case slightly elevated above wax fringe. Appears very much like immature forms of *Tetraleurodes stanfordi* (Bemis).

Adults. Not known.

Collected by Dr. M. A. Cazier at GUERNEVILLE, CALIFORNIA, March 15, 1939, and at ANTIOCH, CALIFORNIA, by E. A. Drews and by W. W. Sampson, April 8, 1940, from *Quercus* sp.

This species differs essentially from *Trialeurodes wellmanae*

(Bemis) by being black and lacking the large semi-transparent areas on the cephalo-thorax.

Trialeurodes drewsi Sampson, new species

(Fig. 5)

Pupal case. Size 0.78 mm. long by 0.48 mm. wide; shape narrowly elliptical; margin regularly crenulate, five crenulations in 0.157 mm.; an irregular row of small papillae occurs behind the margin, along with a few larger in size but fewer in number; dorsum bearing about nine pairs of stomata-like pores on the central portion, and two pairs of small papillae toward the lateral ends of the transverse thoracic slit and a larger pair on the cephalo-thorax; vasi-form orifice subcordate, ribbed; operculum

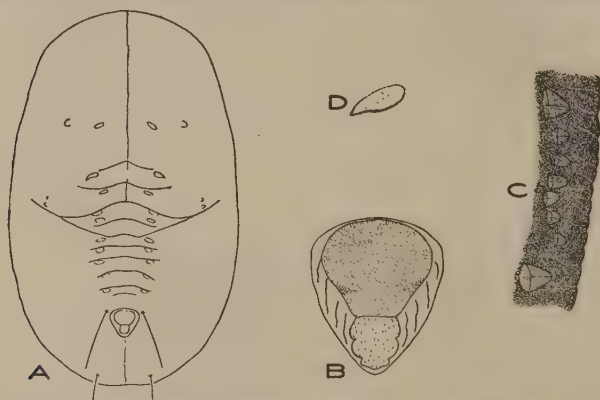


Fig. 5. *Trialeurodes drewsi* Sampson. A, pupal case. B, vasi-form orifice. C, margin of case. D, stomata-like pore.

elongately trapezoidal, narrowing posteriorly, filling slightly more than half of the orifice; lingula nearly reaching the edge of orifice, trilobed on each side, and without setae; two setae much longer than the vasi-form orifice occur near the orifice, and two near the caudal margin of the case.

Case black, greatly elevated on a palisade of white wax; dorsum covered with a layer of clear wax bearing numerous spines of clear wax.

Adults. Not known.

Collected by the writer from *Quercus* sp. at MT. TAMALPAIS, MARIN COUNTY, CALIFORNIA, March 16, 1941.

This species is related to *Trialeurodes tentaculatus* (Bemis), from which it differs by being black in color and having the stomata-like pores.

NEW GENERA AND SPECIES OF TRICHOPSENIINAE
FROM AMERICAN AND AUSTRALIAN TERMITE NESTS
(Coleoptera, Staphylinidae)

BY CHARLES H. SEEVERS

Research Associate, Chicago Natural History Museum

The staphylinid beetles of the subfamily Trichopseniinae constitute a small but very interesting element of the alien insect fauna inhabiting termite colonies. Among the termitophilus beetles they are notable chiefly because of their association with the more primitive termites, and for their wide geographic range which includes both hemispheres. The great majority of groups of termitophilous insects are restricted to one hemisphere or the other, but the thirteen known Trichopseniine species were found in Argentina, British Guiana, the United States, Java, Sumatra, and Australia.

The intent of this paper is to describe the new forms which have been acquired since an earlier report¹ in which I proposed that the Trichopseniinae be given subfamily status because of their distinctive metasternal structure, hind-leg articulation, and male genitalia.

The most noteworthy addition to the subfamily is its first Australian representative, the bizarre genus, *Mastopsenius*. The peculiar facies of *Mastopsenius* scarcely indicates relationship to *Trichopsenius*, but this is in line with the subfamily tendency for each genus to develop its own distinctive habitus. The diversity within the group is more apparent than real for in most respects the basic morphological features are rather similar. The host relationship of *Mastopsenius* is especially interesting, for its host, *Mastotermes darwiniensis* Froggatt, is the most primitive of present-day termites, and sole living representative of the family Mastotermitidae, while the other Trichopseniinae are guests of the Rhinotermitidae.

With more material available for study, it is now evident that the North American genus *Trichopsenius* is comprised of at least

¹ Seevers, C. H. 1941. Taxonomic investigations of some termitophilous Staphylinidae of the subfamilies Aleocharinae and Trichopseniinae (new subfamily). Ann. Ent. Soc. Amer., 34:818-849, 8 pl.

four species instead of one. The literature records *Trichopsenius depressus* Leconte as ranging from Massachusetts to California, but closer study shows that all of the specimens are not conspecific. It is clear, also, that some degree of host specificity exists, and that each species of *Trichopsenius* is restricted to one or a few species of *Reticulitermes*.

The staphylinid beetle, *Schizelythron javanicum* Kemner², collected from the nest of *Schedorhinotermes javanicus* Kemner, at Buitenzorg, Java, should be included in the Trichopseniinae rather than in the Aleocharinae where placed by Scheerpeltz³. Although I have not seen this species, I have no doubt of its relationships; the distinctive Trichopseniine metasternal and hind-leg characters are plainly evident in Kemner's illustrations. *Schizelythron* derives its name from a remarkable character; each elytron is split lengthwise from near the base to the apex, and the lateral half diverges strongly from the medial part.

I am very grateful to Dr. A. E. Emerson for determining the host termites cited in the paper, and to the following men for the gift of specimens or for arranging loans: Dr. R. E. Blackwelder of the United States National Museum, Dr. M. F. Day, Dr. Emerson, Mr. C. A. Frost, and Dr. M. W. Sanderson of the Illinois Natural History Survey.

Mastopsenius Seevers, new genus

Body robust, fusiform; sparsely setose; head moderately deflexed, compressed; clypeus very short; antennae elongated, antennomeres 3-9 campanulate; eyes large; gula sclerotized; mentum strongly transverse, sides rounded, apex emarginate; ligula bifid; labial palpi 3-segmented (third segment bearing a tiny spicule), its second segment elongated and with sides subparallel, the slender third segment articulating with its apex; maxillary palpi 4-segmented, the slender second segment increasing uniformly in width distally, the fourth segment narrowly conical, without a terminal spicule.

Pronotum robust, strongly transverse, anterior and lateral borders margined, basal border margined only along outer one-fourth; surface of pronotum strongly deflexed at base (medially) forming a conspicuous posterior "face" of the pronotum; elytra narrower than pronotum, sides and apical margin uniformly rounded, apical

² Kemner, N. A. 1925. Javanische termitophilen I: *Schizelythron javanicus* n. g., n. sp., eine neue physogastric Staphylinide von einem neuen, nicht zu den Aleochariden gehorigen Typus, nebst biologischen Bemerkungen uber *Jacobsonella termitobia* Silv. Ent. Tidskr., 46:107-126, 1 pl.

³ Scheerpeltz, O. 1934. Staphylinidae VIII. Coleopt. Cat. 130: 1501-1881.

angles obsolete; wings present; prosternum broadly tuberculate medially; mesosternum large, with a slender carinate process meeting a similar process of the metasternum between the middle coxae; metasternum relatively short caudad of the middle coxal cavities, and relatively narrow, its width from median line to side margin scarcely greater than the width of the large metepisternum; metasternal lobe only moderately large, approximating the size of the posterior trochanter.

Mesothorax, metathorax, and the basal abdominal segments greatly swollen; abdomen conical, its sclerites frequently separated, exposing white membranous areas; paratergites absent; lateral plates of ninth segment stout, cylindrical.

Legs moderately stout; tibiae with a few terminal spines; tarsi 5-segmented, basal tarsomere of middle and hind legs greatly elongated.

Genotype. Mastopsenius australis n. sp.

The position of *Mastopsenius* within the subfamily is not clear at this time. Recognition of the genus should offer no difficulty in view of its distinctive form, its antennal, pronotal, and elytral peculiarities, and its host relationship.

***Mastopsenius australis* Seevers, new species**

(Figs. 1, 2)

Head brown; antennomeres 1-3 flavotestaceous, 4-10 with basal one-third black and remainder brown; pronotum dull to shining black, with a median reddish area; elytra piceous to dark brown; abdominal sclerites bright reddish-brown, lateral plates of ninth segment dark brown; legs brown, coxae, trochanters and femora with dusky margins. Head with a pair of bristles on vertex between antennae and one on clypeal margin in front of antennal fossa; pronotum with four transverse, irregular rows of approximately ten fine hairs; elytra also bearing four highly irregular rows of fine hairs; abdominal sclerites sparsely and uniformly clothed with fine, erect hairs. First antennomere strongly clavate (its medial surface concave), three times as long as the second segment, segments 3-4 subequal in length, segments 5-7 a trifle longer, 8-10 decreasing in length, apical segment longer than penultimate. Anterior tibia with terminal ring of uneven spines (8-10); middle tibia with four terminal spines and several spinules; hind femur and tibia subequal in length, tibia more slender, increasing in width from base to apex; bearing one stout apical spine medially and six or so spinules; basal tarsomeres of prothoracic leg decreasing in length, fifth equal to three preceding segments; basal tarsomere of mesothoracic leg three-fourths as long as tarsomeres 2-5, fifth a little shorter than 2-4; basal tarso-

mere of metathoracic leg longer than segments 2-5, fifth a trifle longer than 3-4 combined. Length, 5.5-6.2 mm.; width, 2.5 mm.

Holotype. A male from TOWNSVILLE, QUEENSLAND, AUSTRALIA; collected June 1, 1938, by Dr. M. F. Day; in the collection of the writer. *Paratypes*. Two males, same data as the type; in the collection of A. E. Emerson and the writer. *Host*. *Mastotermes darwiniensis* Froggatt.

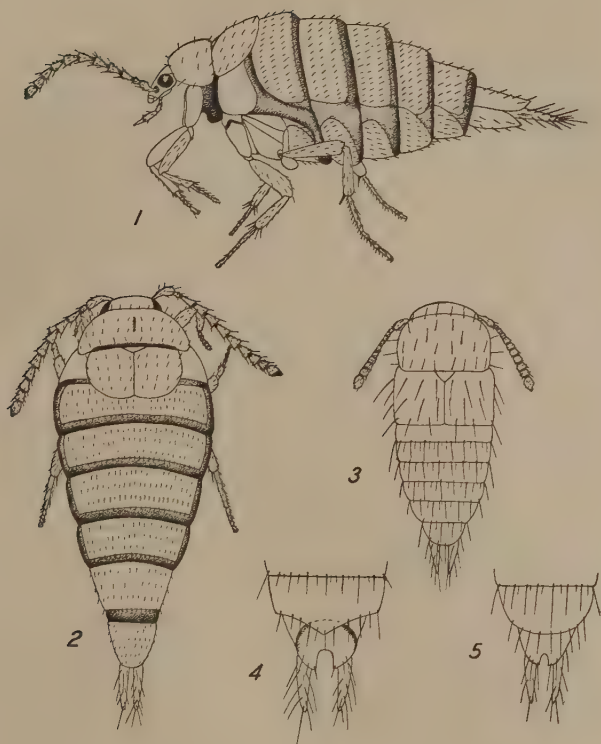
Megaxenistusa Seevers, new genus

Body cylindrical, sparsely setose; head deflexed, strongly compressed; clypeus extremely short; antennae inserted medial to the eye, antennal fossa separated from anterior tentorial pit by a distance equal to length of fossa; labrum feebly sclerotized at base, apical margin produced at middle; eyes large; antenna with broad flat scape (its medial surface concave) and with segments 2-10 subcylindrical; gula sclerotized; mentum trapezoidal, sides converging strongly; labial palpi 3-segmented (third segment with a tiny spicule), second segment asymmetrical, strongly compressed; maxillary palpi 4-segmented (fourth segment with spicule), long and slender, second segment arcuate, third fusiform, fourth conical.

Pronotum robust, transverse, surface depressed on each side of disc, not margined; elytra as broad as pronotum and longer, surface somewhat irregular, with broad shallow impressions, sutural margins not bevelled to form a median groove; wings present; mesosternum short; mesocoxae separated by carinate processes of mesosternum and metasternum; metasternum relatively short and broad; metasternal length (caudad of mesocoxal depressions) seven-tenths the distance from median line to the metepisternum (along the posterior margin); sides of metasternum strongly oblique (with respect to the horizontal plane); metasternal lobes moderate in size, not much larger than posterior trochanters; metepisternum large, four-fifths as broad (at caudal margin) as long. Abdomen stout, cylindrical; paratergites absent. Femora broad, compressed; tibia somewhat less so, sparsely spinose at apex; tarsi 5-segmented, basal tarsomere of middle and hind legs extremely long, exceeding the remainder of the tarsus in length.

Genotype. *Megaxenistusa rhinotermis* n. sp.

Megaxenistusa bears a general resemblance to *Xenistusa* Leconte (Florida to Texas), to which it is probably most closely allied, and from which it differs in these particulars: sutural margins of elytra not bevelled to form a v-shaped groove; metasternum short and broad (median length: distance from median line to side margin :: 7:10), in *Xenistusa* long and narrow (14:10); metepisternum four-fifths as broad as long, in *Xeni-*



EXPLANATION OF PLATE

- Fig. 1. *Mastopsenius australis* n. sp., lateral view.
Fig. 2. *Mastopsenius australis* n. sp., dorsal view.
Fig. 3. *Trichopsenius xenostavipes* n. sp., dorsal view.
Fig. 4. *Trichopsenius depressus* Leconte, seventh and eighth tergites of female.
Fig. 5. *Trichopsenius frosti* n. sp., seventh and eighth tergites of female.

stusa one-third as broad as long; metasternal lobe larger than posterior trochanters and nearly as broad as long, in *Xenistusa* smaller than trochanters and one-third as broad as long.

Megaxenistusa rhinotermitis Seevers, new species

Color reddish-brown, elytra and areas of pronotum darker; head with a pair of frontal and four clypeal bristles; pronotum with four bristles on anterior margin, a subhumeral seta, and four longitudinal rows on each half of the pronotum (a discal row of four, a row of three in the depressed area, a row of two lateral to the impression, and marginal row of three); elytra with five or six longitudinal rows of sparse hairs; abdomen sparsely and regularly setose (most of the setae are short, but there are scattered longer hairs and marginal rows of long bristles). Antennal scape broad, compressed, medial surface concave; second segment short, segments 3-6 subequal, longer than broad, 7-10 decreasing in length and becoming broader, apical segment small, as long as tenth but narrower. Pronotum with a large oval depression lateral to the disc, extending from base to a point about two-thirds the distance to apex; anterior margin arcuate, sides arcuate, converging moderately in front, base bisinuate. Tibiae with one or two apical spines, with irregular rows of long bristles on outer margin and with a brush of stiff hairs on the medial border; anterior tarsi having four basal tarsomeres subequal, fifth equal to 3-4 combined; middle tarsi with first tarsomere equal to others combined; hind tarsi with first tarsomere longer than the others. Length, 3 mm.

Holotype. A female from KARTABO, BRITISH GUIANA; collected August 1, 1924, by A. E. Emerson; in the collection of the writer. *Host*. *Rhinoterms marginalis* L.

TRICHOPSENIUS Horn

Trichopsenius Horn, 1877, Trans. Amer. Ent. Soc., 6:88.
Seevers, 1941, Ann. Ent. Soc. Amer., 34:323.

A generic diagnosis was given by the writer in the paper cited above, and need not be repeated here. The following key to the species is based largely on characters of the females, but this should offer little difficulty as both sexes are almost always collected from a termite colony:

1. Posterior tibiae with two rows of very long, curved bristles.
.....*longipes* Seevers
- Posterior tibiae with scattered, relatively short bristles.....2
2. Eighth tergite of female not incised.....*xenoflavipes* Seevers
- Eighth tergite of female with apical incision.....3
3. Eighth tergite of female carinate laterally; elytral setae about one-fourth as long as elytra.....*depressus* Leconte
- Eighth tergite of female not carinate; elytral setae about one-half as long as elytra.....*frosti* Seevers

TRICHOPSENIUS DEPRESSUS Leconte

(Fig. 4)

Hypocyptus depressus Leconte, 1863, Smithsn. Misc. Coll., 6:30.

Trichopsenius depressus, Horn, 1877, Tran. Amer. Ent. Soc., 6:88.

Color testaceous; head with two bristles on vertex and two on clypeal margin; pronotum with six hairs forming a hexagon on disc, a group of three lateral to disc, a subapical, irregular row of six or so, five or six on the lateral margin, and a basal row of about eight; elytra with three irregular transverse rows of about five bristles; tergites with apical rows of long bristles interspersed with short setae. Antennomeres 3-4 (of both sexes) longer than wide, 5-6 about equal in length and width, 7-10 transverse. Anterior margin of pronotum feebly emarginate medially.

Female. Seventh tergite somewhat produced, angulate medially, each half of apical margin almost straight (obliquely); eighth tergite notched medially, elevated laterally to form a strong semi-circular carina on each side; lateral plates of ninth segment broad, compressed, rounded at apex, rather spatulate. *Male*. Seventh tergite feebly angulate medially, each half of posterior margin almost straight; eighth tergite arcuate, apex rounded, but the converging sides form approximately a right angle; distal end of lateral lobe of aedeagus very slender.

Legs relatively short. Prothoracic leg: entire, .55 mm., femur, .25 mm., tibia, .17 mm., tarsus, .14 mm. Mesothoracic leg: entire, .72 mm., femur, .28 mm., tibia, .22 mm., tarsus, .23 mm. Metathoracic leg: entire, .85 mm. - .91 mm., femur, .26 - .3 mm., tibia, .26 mm., tarsus, .32 - .35 mm.

Length, 1-1.5 mm.

Type locality. LOUISIANA. *Material examined*. FLORIDA: Gainesville, Jacksonville. TENNESSEE: Memphis. *Hosts*. *Reticulitermes hageni* Banks (Florida); *R. virginicus* Hagen (Tennessee). The latter is doubtful because of limited host material.

It is now evident that this species does not range from coast to coast but is more restricted, probably to the southeastern states.

Trichopsenius xenoflavipes Seevers, new species

(Fig. 3)

Color testaceous; chaetotaxy as in *depressus*, but the bristles of the elytra and abdomen one-third longer, the elytral bristles being about one-half as long as elytra; antennomeres 3-7 of male longer than wide, 8-10 feebly transverse; antennomeres 3-6 of female longer than wide, 7-10 transverse, a little broader than in the male; anterior margin of pronotum without medial emargination.

Female. Seventh tergite evenly arcuate, eighth tergite arcuate, not notched, lateral plates of ninth segment slender, tapering to a very acute apex. Legs as in *depressus*. Length, 1.-1.5 mm.

Holotype. A female from the vicinity of WYANDOTTE CAVE, CRAWFORD COUNTY, INDIANA; collected June, 18, 1936, by A. E. Emerson and C. H. Seevers; in the collection of the writer.

Allotype. A male, same data as the type; in the writer's collection. *Paratypes*. INDIANA: 1 female, 1 male, same data as the type. ILLINOIS: 1 female, Olney, Richland County, collected by A. E. Emerson, June 8, 1934; 5 females, 5 males, Urbana, Campaign County, collected October 17, 1941, by B. G. Berger; 47 females, 57 males, Springfield, Sangamon County, collected October 5, 1943, by B. G. Berger. Paratypes in the collections of the Illinois State Natural History Survey (95), A. E. Emerson (4), and the writer (18). *Host*. *Reticulitermes flavipes* Kollar.

The females are readily distinguished from *depressus* by the simple seventh and eighth tergites. Both sexes differ in possessing somewhat longer dorsal bristles.

This species has always been found in the galleries of *Reticulitermes flavipes* but the records are not numerous enough to do more than suggest host specificity. We have no idea of the extent of the range of *xenoflavipes*; its host is a widespread species known from Massachusetts to Vera Cruz in Mexico, but this is scarcely indicative, for *xenoflavipes* appears to be replaced by *frosti* n. sp. in the eastern states.

Trichopsenius frosti Seevers, new species

(Fig. 5)

Color testaceous; chaetotaxy as in *depressus*, but the bristles of the elytra and abdomen one-third longer. Antennae, pronotum, and legs as in *depressus*.

Female. Seventh tergite very feebly arcuate, faintly sinuate each side of middle; eighth tergite with a rather broad, deep incision, but otherwise unmodified. *Male*. Seventh tergite moderately and uniformly arcuate; eighth tergite broadly and obtusely arcuate; the blade-like distal end of the lateral lobe of the aedeagus rather stout. Length, 1.25 mm.

Holotype. A female from SHERBORN, MASSACHUSETTS; collected May 18, 1913, by C. A. Frost; in the collection of the writer. *Allotype*. A male from Sherborn, Massachusetts; collected May 7, 1911, by C. A. Frost; in the writer's collection. *Paratypes*. Two males, one female, same locality, collected May 2, 1915, by C. A. Frost; in the collections of C. A. Frost and the writer. *Host*. *Reticulitermes flavipes* Kollar(?).

Both sexes may be distinguished from *depressus* by the abdominal characters given above.

The host termites were not available for identification, but in view of the fact that *Reticulitermes flavipes* is the only termite species known to occur in Massachusetts, there can be little doubt on this point.

Trichopsenius longipes Seevers, new species

Color flavotestaceous; chaetotaxy as in *depressus*; anterior margin of pronotum bisinuate, feebly arcuate medially, slightly emarginate on each side. Abdomen moderately physogastric; uniformly swollen, the sides scarcely converging posteriorly.

Female. Seventh and eighth tergites simple; lateral plates of ninth segment rather slender, apex acute. Tibiae with two rows of long, fine, curved bristles, those of metathoracic legs much longer. Legs relatively long. Prothoracic leg: entire, .65 mm., femur, .27-.3 mm., tibia, .21 mm., tarsus, .17 mm. Mesothoracic leg: entire, .92 mm., femur, .35 mm., tibia, .30 mm., tarsus, .29 mm. Metathoracic leg: entire, 1.1 mm., femur, .35 mm., tibia, .35 mm., tarsus, .44 mm.

Length, 1.9 mm. (Utah) - 2.8 mm. (California).

Holotype. From SKULL VALLEY, TOOELE COUNTY, UTAH; collected April 9, 1938, by D. E. Hardy; in the collection of the United States National Museum. *Paratypes*. Two specimens, same data as the type; in the collections of the United States National Museum and the writer. *Other material examined*. Two males, one female, from San Antonio Canyon, near Camp Baldy, SAN BERNARDINO COUNTY, CALIFORNIA; collected March 27, 1932, by T. Craig. *Hosts*. *Reticulitermes* sp. (Utah); *Reticulitermes hesperus* Banks (California).

This species differs from those of the eastern states in being physogastric, i.e., in having its abdomen enlarged and the membranous areas exposed. This condition is not very evident in the type specimens due probably to excessive shrinkage during the mounting of them on points. The California examples, received in alcohol, exhibit the condition to a fairly marked degree. This incipient physogastry is interesting in view of the fact that it is such a common feature of termitophiles.

The long tibial bristles, the bisinuate pronotal margin, and the relatively long legs are distinctive features of *longipes*. The legs of the eastern species are on the average only about four-fifths as long as those of *longipes*. The female abdominal characters are, in general, similar to those of *xenoflavipes*, but the dorsal bristles are short as in *depressus*.

The host of the type specimens could not be identified because only the worker caste of *Reticulitermes* accompanies them. Since *Reticulitermes hesperus*, the host of the California examples, is not known to occur in the Utah desert region, it is doubtful if it is their host. From available records, *Reticulitermes tibialis* Banks seems to be only possibility.

OREGON CHRYSOMELIDAE

BY KENNETH M. FENDER

McMinnville, Oregon

The author has in his collection a number of Chrysomelid beetles that are not listed by Hatch & Beller¹ or found in the additions by Malkin². Some of these have been determined by C. A. Frost, L. G. Gentner and Ralph Hopping. Others the author has determined from the available literature. These determiners will be designated by the following numbers: Frost (1), Gentner (2), Hopping (3), and Fender (4).

15233. *Zeugophora varians* Cr. (4), Dayton.

15286.c. *Saxinis saucia californica* Schffr. (4), Bear Springs, Wapinitia Cut-off.

15323. *Pachybrachys donneri* Cr. (4), Durkee; Wallowa Lake.

15521. *Diachus aeruginosus* Lec. (4), Boyer, Salmon River Cut-off.

15604. *Adoxus obscurus* (L.), (4), Boyer, Salmon River Cut-off.

15624. *Colaspidea varicolor* Lec. (1), Medford.

¹ Pan-Pac. Ent., 8:102-108, 1932.

² Pan-Pac. Ent., 19:74, 1943.

15697. *Phaedon armoraciae* (L.), (4), Bear Springs, Wapinitia Cut-off.
15698. *Phaedon oviformis* (Lec.), (1), Neotsu.
21359. *Phaedon niger* Hatch, (4), Forest Grove.
21360. *Phaedon carri* Hatch, (1), Woods
———. *Phaedon punctatus* Hatch, (4), Bear Springs, Wapinitia Cut-off.
———. *Monoxia angularis* (Lec.), (3), McMinnville.
15826. ? *Luperus morulus* (Lec.), Durkee.
22008. *Luperus pallipes* (B. & H.), (4), Medford; Bear Springs, Wapinitia Cut-off.
15900. *Disonycha maritima* (Mann.), (2), Corvallis.
15973. *Orestioides robusta* (Lec.), (1), Elk Lake, Santiam National Forest; Bear Springs, Wapinitia Cut-off.
22021. *Hippuriphila equiseti* (B. & H.), (2), Baker Creek Valley, Yamhill County; Gardiner.
15986. *Epitrix parvula* (Fab.), (2), McMinnville.
16010. *Chaetocnema opulenta* Horn, (2), Bear Springs, Wapinitia Cut-off.
16016. *Chaetocnema confinis* Cr., (2), McMinnville.
16063. *Glyptina atriventris* Horn, (2), Bear Springs, Wapinitia Cut-off; McMinnville.
21398. *Phyllotreta columbianus* Chitt., (2), McMinnville; Baker Creek Valley, Yamhill County; Devils Lake.
21401. *Phyllotreta inconspicua* Chitt, (2), McMinnville.
16099. *Anisostena perspicua* Horn, (3), Portland.
16117. *Brachycoryna horni* Weise, (3), Maupin.

The author has also taken specimens of three genera that have not been previously recorded from the state. These have not as yet been determined as to species. The first is a *Coscinoptera* collected at Durkee. The next belongs to *Exema* and is from Union and near Sisters. The last is an *Oedionychis* that Mr. Gentner seems to think may be new. A small series of this was taken at Bear Springs, Wapinitia Cut-off.

Dr. Hatch listed 93 species and varieties recorded from the state and ten species and two varieties probably occurring in the state, giving a total 105 species and varieties which he estimated probably represented 90 per cent of the Chrysomelidae of the state. Five of the names in this list are among those noted by Dr. Hatch as probably occurring in the state. Mr. Malkin has added 10 more names to the list which, with the 20 new names recorded here, brings the number of species and varieties occurring in Oregon to 135, not including the three new genera noted. I am inclined to think that this number does not represent more than 80 per cent of the species and varieties of Oregon.

NOTES ON THE SYNONYMY, NYMPHS AND DISTRIBUTION OF *HETEROPSYLLA TEXANA* CRAWFORD
(Homoptera, Psyllidae)

BY D. D. JENSEN

Hawaii Agricultural Experiment Station, University of Hawaii

SYNONYMY

Van Duzee (1923) described as *Aphalara mera* a species of psyllid which had been collected in Lower California by the 1921 Expedition of the California Academy of Sciences to the Gulf of California. Examination by the writer of specimens from this series, in the collection of the California Academy of Sciences, has revealed that the species involved is *Heteropsylla texana* Crawford. This distinctive species, which is the genotype of *Heteropsylla*, was described by Crawford (1914) from numerous adults taken on eight different plant species in Texas, Arizona, Colorado and Kansas. The specimens collected in Lower California by Van Duzee show no differences in structure which would permit their separation from *H. texana*.

Caldwell (1941) correctly inferred from Van Duzee's description of *Aphalara mera* that the species could not be referred to *Aphalara* because of the conspicuous pterostigma. Since he had not had the opportunity of seeing Van Duzee's specimens, he placed *mera* tentatively in the genus *Paurocephala* which is closely related to *Heteropsylla*.

On the basis of the facts discussed above, the names *Aphalara mera* Van Duzee and *Paurocephala mera* (Van Duzee) must be considered synonyms of *Heteropsylla texana* Crawford.

NYMPHS

Except for a record by Klyver (1931) of two nymphs taken on *Prosopia glandulosa* (= *P. chilensis*), the literature contains no information on the immature stages of *texana*. Collections and observations made by the writer now permit the following description of the nymph and of its feeding site on the host plant.

The body outline of *texana* nymphs is of the psylliine type as defined by Ferris (1925). In this group the front wing pads

project prominently from the contour of the body and are not produced cephalad at the humeral angle. The last instar nymphs are 2 mm. in length, naked, greenish to greenish-yellow in general color. The antennae are long, reaching to the apex of the wing pads, brown to black apically and on the distal portion of each segment except the basal two. The dorsum is predominantly membranous with the posterior portion of the abdomen, the wing pads, and the head, except the median region, sclerotized. In outline the abdomen is distinctive, being truncate apically and sharply notched laterally at the base of the two dagger-like setae produced on each side from the margin of the sclerotic area. Four similar setae extend caudad from the truncate margin, one from each postero-lateral angle and one on each side of the median line midway to the postero-lateral angle. A second type of setae, wedge-shaped and apically rounded, occurs on the body margin as follows: three on each side of the proximal two-thirds of the abdomen, one on the apical margin of each wing pad, one on each side of the prothorax, and four on the cephalic margin between the antennae. The circum-anal ring encompasses most of the apex of the abdomen and is composed of a row of slit-like pores.

The nymphs usually occur on the young tender growth where they feed on the expanding leaves.

DISTRIBUTION

Klyver (1931; 1932) extended the known distribution range of *texana* to Nevada, Utah and New Mexico.

NEW RECORDS

Adults of *texana*, collected by Van Duzee at Guayamas, Sonora, Mexico, April 9, 1921, occur in the series labelled *Aphalara mera* in the collection of the California Academy of Sciences. The Sonora record, however, was not published with Van Duzee's (1923) record from Lower California.

The following new collection records have been made by the writer.* CALIFORNIA. The species is herewith recorded from California for the first time. All California collections were

* The opportunity of making some of the collections listed was afforded by the United States Bureau of Entomology and Plant Quarantine during the writer's service in the Division of Fruit Insect Investigations.

made on mesquite, *Prosopis chilensis* (Molina) Stuntz (= *P. juliflora* (Swartz) DC; *P. glandulosa* Torr.; *P. odorata* Torr. and Frem; *P. velutina* Wooton). Riverside County: Nymphs and adults: Indio, April 7, 1940, May 15, 1941; Whitewater, May 15, 1941; San Timoteo Canyon, July 8, 1941, and June, 1942. Adults only: Palm Springs, February 5, 1940, November 28, 1940; Indio, January 17, 1941. San Bernardino County: Nymphs and Adults: Twenty-nine Palms, April 6, 1941. Adults only: Barstow, June 1, 1941. NEVADA. Adults only from *Prosopis* sp., Las Vegas, June 1, 1941. UTAH. Adults only from *Prosopis* sp., Leeds, June 17, 1941.

It is probable that *Prosopis chilensis* (Molina) Stuntz is the principal host, and possibly the only one, upon which *texana* completes its entire life cycle. Other plants may serve as temporary hosts for the adults. The indigenous range of *Prosopis chilensis* includes southwestern United States, as far east as Louisiana, Lower California, Mexico, Central America, Chile, and the West Indies. The present known range of *texana* includes all of the southwestern states except Louisiana, Lower California and Sonora, Mexico.

LITERATURE CITED

CALDWELL, J. S.

1941. A preliminary survey of Mexican Psyllidae. Ohio Journ. Sci., 41:420.

FERRIS, G. F.

1925. Observation on the Chermidae. (Hemiptera:Homoptera). Part II. Canad. Ent., 57:46-50.

CRAWFORD, D. L.

1914. A monograph of the jumping plant-lice or Psyllidae of the New World. Smithsn. Inst. U. S. Nat. Mus. Bull., 85:45.

KLYVER, F. D.

1931. Chermidae from Utah, Nevada, and Arizona, including three new species, Pan-Pac. Ent., 7:140-141.

KLYVER, F. D.

1932. Biological notes and new records of North American Chermidae (Homoptera). Ent. News, 43:12.

VAN DUZEE, E. P.

1923. Expedition of the California Academy of Sciences to the Gulf of California in 1921. (The Hemiptera). Proc. Calif. Acad. Sci., 12:199-200.

NOTES ON THE SPECIES OF *PODABRUS* OF OREGON
AND WASHINGTON
(Coleoptera, Cantharidae)

BY KENNETH M. FENDER
McMinnville, Oregon

A few records of Oregon and Washington *Podabrus* have been cited by LeConte (1881), Fall (1928), Ralph Hopping (1929), and the author (Fender, 1943). They give no intimation of the actual number of species found. The present report is based on material in the collections of Dr. M. H. Hatch at the University of Washington and of the author. Mr. M. C. Lane has kindly given the author all of the Cantharidae he has collected.

Podabrus latimanus Motsch. Yamhill River south of McMinnville, Oregon. Fall reports this species from "middle California." The male of *P. latimanus* has a lateral spine midway on the front femora. This characteristic was mentioned by neither LeConte nor Fall in their studies of the genus. Mr. C. A. Frost has kindly confirmed the existence of such spines on the front femora of LeConte's male of the species.

Podabrus cascadenis Fender. Clackamas Lake, Clear Lake and Hood River Meadows, Oregon. These are the only records to date.

Podabrus comes LeConte. Throughout the region but it is more common west of the Cascade Range.

Podabrus conspiratus Fall. Wash.: LaGrande (Lane), Manchester (Hatch), Green River, King County (Hatch), Seattle (Hatch). Ore.: McMinnville, Boyer, Corvallis. Fall described this species from Skagway, Alaska. No other records have been found.

Podabrus pruinosus LeConte. The typical form of this species is found occasionally throughout the northwest. The variety *diversipes* Fall is much more common than the typical form in the area.

Podabrus falli Hopping. Wawawai, Wash. (Lane), Wallowa Lake, Ore. This species was described from Otter Creek, B. C., West Bank, B. C. and Nine Mile, Princeton, B. C. This is a rather variable species. The author has one specimen in which the pale

bases and margins of the elytra are so extended as to almost completely obliterate the black area.

Podabrus fulvus Fall. Black Snake Ridge, Blue Mts., Wash. (Lane), Lewis Peak, Blue Mts., Wash., Mottet Meadows, Blue Mts., Ore. Previously recorded by Fall from Kaweah, Calif. and Atwell's Mills, Tulare County, Calif.

Podabrus lanei Fender, new species

Male. Length 10-12 mm. Head black with muzzle yellow; antennae black with the underside of the basal two segments pale varying to a condition in which the basal segment is pale with the other segments faintly annulated at the base. Pronotum yellow with a black discal concavity; elytra and legs varying from yellow to black. Head shining, sparsely finely punctate in front of the antennae, coarsely closely punctate behind; eyes large; head wider than thorax; antennae two-thirds the length of the body, the second segment as long as the third. Pronotum transversely quadrate, the front angles rounded, the sides straight, converging slightly to the hind angles which are prominent; surface shining, finely sparsely punctate, more coarsely so anteriorly, convexities moderate, median impressed line not eroded, extending from base to apical third. Elytra shining, sparsely punctate basally, becoming finely rugose apically; vestiture cinereous, recumbent, fine and rather sparse. Front tibiae and hind coxae not modified. All claws armed with a broad acute tooth.

Female. Similar to male, eyes smaller, head just perceptibly wider than thorax, antennae a little shorter.

Holotype male, BLACK SNAKE RIDGE, BLUE MTS., WASH., May 25, 1941, collected by M. C. Lane. *Allotype* female, UNIONTOWN, WASH., May 16, 1940, M. C. Lane. *Paratypes*: two males, same data as holotype; three females, same data as allotype; one male and one female, UNIONTOWN, WASH., May 20, 1939, also collected by Mr. Lane; one male, WALLOWA LAKE, ORE., June 22, 1941, K. M. and D. M. Fender; two males, three females, PINE CREEK, BAKER, ORE., June 13, 1940, three males, DURKEE, ORE., June 17, 1941, collected by K. M. and D. M. Fender; one male, two females, ROCKY BAR, IDAHO, collected by M. C. Lane, and two females, ASHTON, IDAHO, June 15, 1939, collected by M. C. Lane.

For my types I have chosen specimens that seem to be most representative of the species. They have the antennae black with the under side of the first segments pale; the elytra are a dingy yellow and the legs black. In Fall's key *lanei* would run to

P. extricatus Fall or *P. tejonius* LeC. and the dark form to *P. bolteri* LeC. It differs from each of these species by its large size, 10-12 mm. in *lanei*, 6-7 mm. in *extricatus*, 7.5 mm. in *tejonius* and 6.5 mm. in *bolteri*. In comparative lengths of the second and third antennal segments it can also be separated: The segments equal in *lanei*; the third segment twice as long as the second in *extricatus*; the third one-fourth longer than the second in *tejonius*; the third distinctly longer than the second in *bolteri*.

Podabrus extricatus Fall. Baker Creek Valley, McMinnville, Oregon. No previous records could be found other than those of Mr. Fall in his description of the species. He cites Placer and Plumas counties, California.

Podabrus scaber LeConte. Wallowa Lake, Oregon. Previously reported from Oregon and Vancouver by LeConte, Stickine River, B. C., by Wickham and Glacier Park, Montana, by Fall.

Podabrus macer LeConte. This species is apparently confined to the Cascade Range in Oregon and Washington. Fall knew it only from the middle California coast range.

Podabrus piniphilus Esch. The commonest species of this region. It is very abundant west of the Cascades and quite common to the east of them.

Podabrus extremus LeConte. Mt. Bonapart, Okanogan County, Wash. (Lane). Previous records of this species are, Hudson Bay; Labrador; Mt. Washington, New Hampshire; Banff, Alberta; Skagway, Alaska. My specimen, a male, keys out to *P. extremus* but the sides of the pronotum are angularly sinuate, whereas Fall noted them as being nearly straight and just perceptibly convergent from the obliquely truncate front angles. Fall's specimens, however, were apparently all females. I place this specimen tentatively in this species.

Podabrus bolteri LeConte. Bear Springs, Wapinitia Cut-off, Oregon. LeConte's unique type is from Lake Tahoe, California. Fall concluded that the range of this species was the Sierras of middle California.

Podabrus fissilis Fall. Dr. Hatch has a fine series of this species from Paradise Park and Reflection Lake, Mt. Rainier, Wash. *P. fissilis* has been recorded from Emerald Lake, B. C., and Skagway, Alaska, by Fall, and Hopping notes a long series taken at Emerald Mine south of Prince Rupert. Hopping states that an occasional female was nearly black. Several of Dr.

Hatch's specimens, both sexes, have the thorax entirely black, the only pale area being the pale muzzle.

Podabrus instabilis LeConte. Blue Mts., Oregon. Cornucopia, Oregon (Hatch), Green Springs Pass, Jackson County, Oregon (Hatch), Lewis Peak, Blue Mts., Wash., Windemere, B. C. (Hatch). Fall gave the known range as the Sierras of California.

Podabrus danielsi Fender. (2 females) Berkeley Park, Mt. Rainier, Wash. (Lane). These specimens agree nicely with my female paratype. Females in this genus are often difficult to place as many do not have the unguis characteristics used to separate the males. *Danielsi* was described from Breitenbush Lake, Mt. Hood National Forest, Oregon.

Podabrus cavicollis LeConte. Washington: Seattle (Hatch), Olympia Hot Springs (Hatch), Quillayute (Hatch), Kirkland (Hatch) and LaGrande (Lane). Oregon: Medford, McMinnville, Boyer, Bear Springs, Blue Mts., and Devils Lake. Fall cites Lake Tahoe, California, and Trinity, Plumas, Eldorado, Sonoma counties, California, and Ormsby County in western Nevada. Mr. Lane has kindly given the author three males of a variety of *cavicollis* that has the elytra entirely black. They were collected at LaGrande, Wash. For this variety I propose the name of *P. cavicollis* var. *hatchi*, nov.

REFERENCES

- LeConte, J. L. 1881. Synopsis of the Lampyridae. Trans. Am. Ent. Soc., 9:45-50.
Fall, H. C. 1928. A Revision of the North American Species of *Podabrus*. Ent. Am., (n.s.) 8 (2): 65-103.
Hopping, R. 1929. New Coleoptera from Western Canada IV. Can. Ent., 61:251-253.
Fender, K. M. 1943. Studies in the Cantharidae. Pan-Pac. Ent., 19:64-66.

EDWARD W. BAKER

Dr. Edward W. Baker has recently been added to the staff of the Division of Insect Identification, Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, Washington, D. C. Dr. Baker will be responsible for identification and taxonomic investigations of Acarina. His headquarters will be at the United States National Museum.